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How Has Instability in World Markets Affected Agricultural Export Producers in Developing Countries?

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World prices are notoriously unstable, and unless farmers can efficiently diffuse the risky returns from export crops, price variability may impede the expansion of agricultural exports in many developing countries.

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World prices have been traditionally unstable, but Hazell, Jaramillo, and Williamson find the much-publicized turbulence in world markets in the mid-1970s and early 1980s to have been more a statistical fluke — an unlucky chance sample — than the beginning of any longer term increase in market instability.

Variability in world prices has been almost entirely transmitted to developing countries in the dollar value of their export unit values. However, it has not been fully transmitted to average producer prices. Producer prices have been buffered by real exchange rates, domestic marketing arrangements, and government intervention, but still the level of instability remains sizable — and is the dominant source of instability in crop revenues for most producers.

Unless farmers are able to diffuse the risky returns from export crops, price variability may seriously impede the expansion of agricultural exports in many developing countries.

This paper is a product of the Agricultural Policies Division, Agriculture and Rural Development Department. Copies are available free from the World Bank, 1818 H Street NW, Washington DC 20433. Please contact Cicely Spooner, room N8-037, extension 30464 (54 pages with charts and tables).

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by
Peter Hazell, Mauricio Jaramillo,
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Introduction

The late 1970s and early 1980s was a period of considerable instability in world agricultural markets. For many commodities, prices fluctuated between extremes not observed in over 25 years (for example, international coffee prices in Figure 1). The problem may have been aggravated for many countries by accompanying high levels of instability in currency exchange rates, especially that of the U.S. dollar, and world interest rates.

These sorts of upheavals can be detrimental to the stability of export earnings for developing countries and hence their ability to grow and to service debt. The literature on these relationships is extensive (see MacBean and Nguyen [1987] for a recent review and update).

The stability of prices actually received by the producers of exports in developing countries is also of concern. These typically small-scale producers have limited access to off-farm risk management aids (for example, futures and options markets) and must instead rely upon self-insurance mechanisms such as crop diversification. These can be costly to their average incomes and lead to lower levels of national export earnings. This paper examines whether instability in world market prices is transmitted to the prices these farmers receive and whether this has any significant destabilizing effect on their incomes. Whether there has been any significant change in these relationships in recent years is also considered.

Many factors affect the relationship between movements in

world prices and the prices farmers receive. The key steps in the transformation from dollar world prices to local currency value producer prices can be explained with the aid of the data presented in Figure 2 for the case of rice in Thailand. All variables are valued in constant prices, a practice followed throughout this paper.

The transformation from world price to producer price begins with the average export price received by a country, the export unit value or EUV, which need not closely follow the world price. Differences between the world price quotation and the EUV can be explained by differences in quality, by the seasonal distribution of exports, by forward pricing contracts and by the particular world market location used. For some crops such as coffee and sugar, preferential access to protected markets for all or part of a country's exports can also account for differences between the EUV and the world price. Since they may also vary over time, these factors not only explain average price differentials but also account for less than perfectly correlated price movements.

The transformation of EUVs from U.S. dollar to local currency units is determined by the real exchange rate. Of course, the real exchange rate is affected by macroeconomic forces and policies, but agricultural export performance, and hence movements in EUVs, can themselves be an important factor. In some cases, it is possible that movements in EUVs induce offsetting movements in the real exchange rate that tend to

stabilize the domestic value of the EUV (see Gelb [1974]). For example, through its effects on export earnings and the money supply, a reduction in the dollar value of the EUV of an important export may lead to a devaluation of the currency which will tend to stabilize the EUV valued in local units.

The mapping of EUV in local currency to the average producer price is primarily affected by three factors. The first is the share of production sold in the domestic market or carried forward in stocks, especially if there are quality differentials between the domestic and export markets. Second, government intervention in the form of export taxes, attempts at price stabilization, or other interventions in the domestic market induce less than perfectly correlated movements between the domestic price and the EUV. The third factor is the size and temporal behavior of marketing and processing margins retained by market intermediaries.

In this succession of price relationships, there is a further transformation from average producer prices to the prices received by individual farmers which depends upon farm-specific production and marketing characteristics, such as time of sale. However, this relationship is not pursued in this paper; the analysis is instead confined to the available data on average price movements.

In tracking the relationship between fluctuations in world prices and the average prices that producers receive in individual countries, we attempt to identify the stabilizing or

destabilizing role played by each of the above links in the chain. Each relationship is judged in terms of its statistical contribution to the observed variability in producer prices.

Methodology

Numerous alternative measurements of instability have been proposed in the literature (see Demeocq and Guillaumont [1985], Knudsen and Parnes [1975], Offutt and Blandford [1983], Scandizzo and Diakosawas [1987] and Stein [1977] for reviews), all of which depend on a measure of the deviation between actual and "normal" outcomes. The normal outcome embodies some concept of a systematic and thus stable component to the changes in prices over time. It may simply be the mean price or, more typically, a trend and/or cyclical component.

An important consideration in choosing an appropriate concept of normal prices is whether one wishes to measure only that part of price variability that cannot be predicted ex ante or to measure the total variability that is observed ex post. In order to simplify the terminology used in this paper, the former is referred to as price risk confronting decision makers, the latter as total variability. Measurement of total variability in most cases requires fitting linear, exponential or more complicated regressions to a price series to isolate the underlying secular trend. Measurement of price risk, on the other hand, requires an appropriate forecasting model to predict prices each period utilizing only that information available to decision makers at the time of making their forecasts.

The distinction between total variability and risk is also important in determining how to treat any serial correlation in the price data. When defined as the variability around trend, total variability also includes any systematic but non-trend component to the data and this should not be removed through procedures that correct for serial correlation. In contrast, measurement of price risk requires removal of any systematic component to the price data that could be used to improve the price forecasts postulated each period. Moveover, when autocorrelation in the world price series is removed, the changes in the results did not alter the qualitative conclusions of this paper.

In analyzing the transformation from world to producer prices, this paper is generally concerned with total (ex post) price variability. Linear trend regressions[1] are used to obtain the normal prices for each year since no a priori reason was identified to expect other kinds of growth patterns in time series of real prices. However, since at the producer price level it is the price that farmers expect to receive each year that presumably drives decisions, measures of risk in producer prices are also computed.

The coefficient of variation (CV) of the detrended price data is used as a summary measure of variability. This CV is a

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[1] When applicable (based on Glejser's [1969] test), we corrected for heteroscedasticity using a weighted least squares approach (Neter et al. [1985]).

measure of relative dispersion around the original mean which indicates changes in variability when the standard deviation of the detrended data increases or decreases at a faster rate than does the mean.

A key emphasis in this paper is the changing patterns of variability in prices. Unfortunately, this leads to methodological issues that have been less than satisfactorily resolved in the literature. A common test for changes in variability over time is to divide the available data into two or more historical periods and to compare the average variability calculated for these periods. This approach can be sensitive to the particular periods chosen and, unless there are sound structural reasons for choosing particular periods, the results are arbitrary.

Two alternative methods for measuring changes in variability over time are adopted in this paper. First, ten-year moving coefficients of variation are calculated and tested for a significant trend over time using a linear trend regression. The second approach is a test proposed by Glejser (1969) and Johnston (1972) and used by Scandizzo and Diakosawas (1987) which involves regressing the absolute value of the residuals from the initial trend regression against time and testing for significant trend. That is, given the residuals u_t from a trend equation such as

$$(1) \qquad P_t = a + bt + u_t,$$

where P_t is price and t time, the regression model

(2) $$|u_t| = \alpha + \beta t + e_t$$

is fitted and the slope coefficient is tested for significant difference from zero.[2] This residual trend method is preferable to the moving CV test because it is less influenced by extreme price outcomes.

Correlation coefficients for detrended data are used to measure the patterns of association between different prices. To test for changes in covariance patterns over time, however, the residual trend approach can be generalized as follows. With u_t and v_t denoting the residuals from the initial trend equations (1) for two prices, one regresses the product of the two against time,

(3) $$u_t v_t = \alpha + \beta t + e_t,$$

and tests to see if β is significantly greater or less than zero.[3]

Data Sources

World price data, available for 1949-87, were obtained from the World Bank's International Economics Department, International Commodity Markets Division. These are the international prices of standard types of commodities in major

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[2] Hereafter, the t statistic for the β from the regression of the absolute value of the price trend residuals against time (equation [2]) is referred to as the t statistic from the residual trend.

[3] The t statistic for the β from the regression of the cross product of price trend residuals for two prices (equation [3]) is referred to as the t statistic from the cross-product trend.

markets (see Annex 2 for specific sources and definitions). Individual country data on trade and producer prices were obtained from the FAO Trade Yearbook and the FAO Production Yearbook, respectively.[4] The source of price index and exchange rate data is the IMF's International Financial Statistics Yearbook.

Export revenue is valued f.o.b. in U.S. dollars. Export unit values (EUV) are computed by dividing revenue by the total quantity of exports (in metric tons) of the particular commodity. Therefore, except where noted, EUVs are valued in U.S. dollars per metric ton. Producer prices are valued in local currency per metric ton.[5]

World prices, as well as export revenue (and therefore EUVs), are deflated to 1980 U.S. dollars with the IMF's "World Consumer Price Index", a GDP-weighted average of country consumer price indices (CPI). EUVs are also deflated with the World CPI instead of the national CPIs to reflect the EUVs' purchasing power in international markets. In contrast, the producer prices are deflated to 1980 prices by the appropriate national CPI. Because multiple data sources are used in this study, there are some differences in commodity definitions (see

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[4] Trade data are available for the period 1961-87. Producer price availability varies by country/commodity case but is usually 1966-87.

[5] FAO producer prices are "prices received by farmers" and refer to the national average of individual commodities comprising all grades, kinds and varieties.

Annex 1) which could not be avoided.

Variability in World Prices

Table 1 summarizes the patterns of variability in the world prices of major agricultural commodities that are traded internationally. Most commodities exhibit variable prices, with CVs in excess of 20% for the entire period 1949-87. Only bananas and tobacco have CVs of less than 10%, while those for cocoa, coffee, rubber and sugar exceed 30%.

The ten-year moving CVs indicate an increase in world price variability over the period 1949-87 for most commodities. Indeed, linear trend regressions run through these moving CVs reveal positive and significant trends for all commodities except cotton and rubber. The increases in the moving CVs, however, are largely due to declining mean prices as confirmed by the significant and negative trends for the initial price trend equations and the ten-year moving means.[6]

Moreover, the ten-year moving standard deviations (measures of absolute variability) reveal a significant positive trend for only eight of the fifteen commodities, a significant negative trend for three, and an insignificant trend for four. The trends for the absolute value of the price trend residuals (the residual trend of equation [2]) indicate even less systematic increases in the absolute variability of world prices. Only one

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[6] The downward trend may be overstated because a CPI deflator which does not correct for quality improvements in manufacturing is used.

of these regressions (tobacco) has a significant and positive trend.

Thus while there has been a significant positive trend in the moving CVs for all commodities except cotton and rubber, these increases are attributed more to declining average prices than to increases in absolute variability. Undeniably, the price movements of the late 1970s and early 1980s were sizeable. However, within the longer historical context of the residual trend test, they should be viewed as an unfortunate sample rather than necessarily portending systematically less stable patterns for the future.

Similarly, Scandizzo and Diakosawas (1987) found no evidence of a systematic increase in instability in their analysis of the terms of trade for major agricultural commodities over the longer historical period 1900-82. Also using the residual trend method, they found that only the residual trends for the barter terms of trade for cocoa, rice[7] and sugar are significant and positive at the 5% level; they found only negative significant trends (for maize and sugar[8]) for the single factoral terms of trade.

While world prices tend to be highly correlated, there is little evidence to suggest that their movements have become significantly more synchronized over time. Although not

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[7] The regression for rice also included a positive trend squared term.

[8] Both regressions included a negative trend squared term.

displayed because of space limitations, of the 105 correlations between prices of the commodities listed in Table 1, forty-four (42%) are significantly different from zero[9] during the period 1949-87. Moreover, all of these forty-four correlations are positive and, as would be expected, tend to be concentrated amongst substitute commodities (such as wheat, rice and maize, or palm and coconut oil). Regressions based on equation (3) reveal that only ten of the 105 cross-product relations exhibit any significant trend over the period 1949-87. Nine of the trends are positive, of which six involve tobacco.

Variability in Export Prices for Selected Countries

In order to examine the relationship between world market instability and the prices that producers of exports receive, one must first consider the link between world prices and the average export prices (EUVs) received by individual countries. As discussed above in reference to Figure 2, there can be important differences between the world price and the EUV for a particular country and commodity. These discrepancies may be due to quality differentials, seasonality of exports, different market destinations, and privileged access to protected markets.

The country analysis is limited to twenty-six developing countries. The criterion for selection was average total agricultural export value greater than 50% of total merchandise export value during the period studied (1961-87). By country,

[9] At the 1% level (one-tailed tests).

commodities were chosen for analysis if the commodity export value was on average at least 2% of total agricultural export value.[10]

For most countries, the CVs of the selected dollar-denominated EUVs fall in the 20 - 40% range for the period 1961-87 (Table 2). These CVs are markedly similar to the CVs for world price. Of the thirty-eight country/commodity cases in Table 2, the CV of the EUV falls within 10% of that of world price in twenty (53%) cases. Large departures of the CV for EUV from that of world price are largely restricted to bananas, an unusual commodity in that the world market is dominated by multinational companies and tends to be geographically segmented. The close pattern of association between EUVs and their corresponding world prices is also confirmed by high correlation coefficients, of which 65% exceed 0.9 and 89% exceed 0.8.

While the average levels of instability are sizeable over the entire period, the t statistics for the EUV residual trend indicate that with few exceptions there has been no significant trend increase at the 5% level in the absolute variability of EUVs for individual countries since 1961. The seven exceptions involve only coffee and cocoa; in fact, at the 10% level, all but two of the cocoa and coffee cases exhibit significant t statistics. By compounding already high levels of instability for these two commodities, these trends undoubtedly present

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[10] Defined as total agriculture, fish and forestry export value by FAO.

challenging problems for small countries, such as Costa Rica, Ghana and Rwanda, which specialize in coffee or cocoa.

Variability in Producer Prices

The transformation from EUV in U.S. dollars to the average producer price (PP) in local currency depends primarily on four factors: the real exchange rate, the share of production sold in the domestic market, especially if there are quality differentials between the domestic and export markets, government intervention which affects the market price (for example, export taxes or control of the domestic price), and the marketing and processing margins retained by market intermediaries. Therefore, even though EUVs seem to move quite closely with world prices, producer prices do not necessarily follow suit.

The first column of results in Table 3 summarizes the level of total variability in producer prices valued in local currency for the selected countries and commodities. These prices are available for shorter periods than both world prices and EUVs. However, when they are compared to the corresponding U.S. dollar EUVs for the same periods (the third column of Table 3), it is clear that producer prices are typically much less variable than EUVs. Similar findings are reported by MacBean and Nguyen (1986), Krueger, Schiff and Valdes (1988), and Hazell (1988). Producer prices valued in local currency also tend to be weakly or even negatively correlated with their corresponding EUVs (Table 3). This result confirms that the combined influence of real exchange rate movements, government policies, market intermediaries and

a domestic market has a significant buffering effect on producer prices. The lowest CVs for producer prices are found in Africa, where there is a stronger tradition of government intervention in the pricing of export crops.

The residual trend t statistics in Table 3 reveal that there is no evidence of significant trend increases in the absolute variability of producer prices -- not even for coffee and cocoa as is the case for the EUVs. Furthermore, the t statistics for the cross-product trend reveal that movements in producer prices and EUVs have not become more synchronized over the period. As with world prices, average producer prices have also trended downward (the fifth column in Table 3).

In analyzing the variability of producer prices, it is useful to distinguish between that part of the variation that is predictable by producers and that which is not. Producers can always make at least some resource adjustments to predictable movements in prices and thereby perhaps avoid any sizeable economic loss. In contrast, unpredictable price changes represent a risk, particularly when producers must commit resources well in advance of harvest. Incorrect predictions likely result in errors in resource use and hence inefficiency and economic loss.

The measurement of price risk requires estimation of the prices forecasted by producers each year. Given the paucity of data on relevant variables that may in theory influence producers' price forecasts, elaborate modeling attempts are

eschewed in this paper; instead, a simple three-year lagged price equation was used as a predictive device. Specifically, the predicted price for year t is the weighted average of the prices observed in the preceding three years, where the weights were estimated by regression analysis.[11] When the deviations of the actual prices from the predicted price are calculated, it is, of course, no longer necessary to detrend the original price series.

The estimated CVs for price risk are reported in the second column of Table 3. In most cases, these CVs are marginally smaller than the CVs reported for total price variability; they are actually larger in one third of the cases. Unless producers have access to relevant information other than past prices, it would appear that price risks are not all that different from total price variability.

The substantial buffering of producer prices revealed in Table 3 warrants further analysis. Given the scope of this paper and the available data, the separate roles that government policy and domestic factors play in this buffering effect cannot be isolated.[12] However, the role of changes in the real exchange rate can be isolated using a simple variance decomposition analysis.

Let $EUV_{\$}$ and EUV_{C} denote export unit values in U.S. dollars

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[11] With very few exceptions, the error term in this simple forecasting model did not exhibit significant levels of serial correlation.

[12] Nash and Knudsen (1989) analyze price stabilization attempts by the governments of a number of countries.

and local currency, respectively, rr the real exchange rate,[13] and PP the producer price in local currency. By definition,

$$EUV_c = EUV_\$ * rr. \tag{4}$$

The relationship between EUV_c and PP is not obvious because of the roles of marketing intermediaries between the producer and the exporter, the domestic market and government interventions, but it can be approximated with a linear regression of the form

$$PP_t = a + b * EUV_{c,t} + u_t, \tag{5}$$

where u_t is a stochastic residual. Using (4), it follows that

$$PP_t = a + b * (EUV_{\$,t} * rr) + u_t.$$

Using an approximation due to Goodman (1960), the variance of PP is

$$\begin{aligned} V(PP) = b^2 [&\underline{\underline{rr}}^2 * V(EUV_\$) + \underline{\underline{euv}}_\$^2 * V(rr) \\ &+ 2 * \underline{\underline{rr}} * \underline{\underline{euv}}_\$ * Cov(EUV_\$, rr) \\ &- Cov^2(rr, EUV_\$) + R] + \sigma_u^2, \end{aligned} \tag{6}$$

where V indicates the variance of a variable and Cov the covariance between two variables, double underlines ($\underline{\underline{rr}}$,$\underline{\underline{euv}}_\$$) denote sample means, R is a residual, and σ_u^2 is the variance of u_t.[14]

Given (6), the variance of PP can be decomposed into five variability components: $V(EUV_\$)$, V(rr), $Cov(EUV_\$, rr)$, R and σ_u^2.

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[13] A simple CPI-weighted real exchange rate is used in this paper. The real local currency/U.S. dollar rate is defined as the nominal local currency/U.S. dollar exchange rate multiplied by the ratio of the world CPI to the national CPI.

[14] Note that OLS estimation of (5) ensures that u_t is uncorrelated with $EUV_{c,t}$, and hence there are no covariance terms involving u in equation (6).

The results of this analysis for each of the selected countries and commodities are reported in Table 4.[15] The results are expressed in percentage form so that for each country/commodity case, the row total is 100%.

The two most important positive components in the variance of PP are the variance of $EUV_{\$}$ and σ_u^2. σ_u^2 is the primary source of variation in 56% of the country/commodity cases considered in Table 4, while $V(EUV_{\$})$ is most important in 35% of the cases. In the remaining 9% of the cases, the variance of the real exchange rate dominates.

By definition (equation [5]), σ_u^2 is that part of variance of producer prices not explained by the variance of EUV_c. Among other things, therefore, it is that part of V(PP) explained by government policy and the effects of the domestic market and marketing intermediaries. The results in Table 4 reveal that σ_u^2 is not only an important source of variation in producer prices in all of the country/commodity cases but also the dominant source for more than half. Furthermore, σ_u^2 tends to be more important in Asia and Africa than Latin America.

While the variance of $EUV_{\$}$, and hence variability in world prices, is the dominant component of the variance of producer prices in 35% of the country/commodity cases, it is surprisingly unimportant in most of the other cases. Clearly, for many countries and commodities, domestic factors are a much greater

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[15] The decomposition procedure was applied to the detrended data centered on the original means.

source of variability in producer prices than is variability in the world price. In most cases, this result likely arises because by muting the influence of EUVs on producer prices, the role of the domestic factors and government policy becomes relatively rather than absolutely more important in explaining price variability.

Variability in the real exchange rate, V(rr), is an important source of variation in producer prices in several country/commodity cases. As would be expected, however, it plays a more significant role as a compensatory or buffering factor through its contribution to the negative covariances between rr and $EUV_{\$}$. That is, fluctuations in $EUV_{\$}$ are inversely correlated with movements in the real exchange rate; this interaction tends to buffer the producer price valued in local currency. Sizeable in many cases, the covariance between rr and $EUV_{\$}$ is negative for all but one of the country/commodity cases in Table 4.

The residual component R arises from various higher order moments in a Taylor expansion and as such has no easy interpretation. However, the contribution of R to the variance in producer prices is quite small for most country/commodity cases and therefore can be effectively ignored.

Variability in Producers' Revenue

Although the variability of producer prices is typically much less than that of world prices, it is still substantial and could, in many cases, be a major factor in the variability of

producers' income.

In the absence of data on costs of production, we use producer revenue as a proxy for income. Table 5 reveals that the CVs of producer revenue[16] are mostly in the 20 - 40% range and are typically larger than the CVs for producer price (third column in Table 5) -- more than 20% larger in nearly two-thirds of the cases. Except for six cases, there is no statistically significant pattern of increase in the variability of producer revenue over the period studied (last column of Table 5).

The levels of revenue risk are almost as high as total variability (second column in Table 5) with CVs clustered in the 15 to 30% range. As with producer price risks, risk was measured as the deviations around three-year weighted averages of past revenues, where the weights were obtained from regression equations. These levels of risk are quite high, as illustrated by the following exercise. Assume that farmers maximize expected utility; then, as shown by Newbery and Stiglitz (1981), their welfare gain from income stabilization as a proportion of mean income (which we assume remains unchanged) can be approximated by $\frac{1}{2}\phi\Delta CV_y^2$, where ϕ is the coefficient of relative risk aversion and ΔCV_y^2 is the change in the squared CV of income. With reasonable levels of risk aversion (for example $\phi = 1.5$), and an initial CV of income risk of 0.25, removal of all income risk leads

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[16] Producer revenue is exponentially detrended in this paper since geometric growth rates in quantity and revenue are expected as a result of technological change.

to a welfare gain of ½(1.5)(0.25) = 0.188 of mean income. That is, the producer welfare attached to a risky (export) activity with E(Y) = 1 and CV = 0.25 is only 80% of mean income. If, as is often the case, producers are specialized in only one or two export crops, then these levels of risk could be a significant deterrent to the expansion of agricultural export crops in developing countries.

The importance of price variability in explaining these relatively high levels of instability in producer revenue can be addressed with the aid of a decomposition procedure similar to that used in equation (6). Revenue is defined as P*Q, where P and Q denote producer price and quantity, respectively.[17] Using the approximation due to Goodman (1960), the variance of revenue is then

$$(7) \qquad V(R) = \underline{\underline{P}}^2 * V(P) + \underline{\underline{Q}}^2 * V(P) + 2 * \underline{\underline{P}} * \underline{\underline{Q}} * Cov(P,Q) - Cov^2(P,Q) + R,$$

where the conventions follow those used in equation (6). The decomposition results for each country/commodity case are illustrated in Table 6.[18] Price variability is the dominant source of revenue instability in two-thirds of the cases, including all but one of the cases in Asia and Latin America. Production variability dominates in some of the African cases,

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[17] Price is detrended linearly; quantity is detrended exponentially (see note 15).

[18] The decomposition procedure was applied to the detrended data centered on the original mean.

especially those in West Africa and the Sahel.

Since the analysis is confined to export crops, one should not expect a significant buffering effect in the price-quantity covariance term. The results in Table 6, as well as the close-to-zero correlations between price and quantity in the fourth column of Table 5, support this expectation.

Conclusions

The world prices of most agricultural commodities have been variable, with CVs in excess of 20% during the period 1949-87. Moving CVs of these prices have trended upwards over time, mainly as a result of a steady decline in average prices rather than any trend increase in absolute variability. At this point in time, the much publicized turbulence in world markets of the mid 1970s to early 1980s appears to have been more a statistical fluke than the beginning of any longer term increase in market instability.

Nearly all the variability in world prices has been transmitted to developing countries in the dollar value of their EUVs. Many coffee and cocoa exporting countries have even experienced a trend increase in the absolute variability of their EUVs. Considering the levels of variability of the world prices of these two crops (CVs greater than 30%), small specialized producers such as Costa Rica, Ghana and Rwanda must face difficult destabilizing problems in their export earnings.

In most cases, however, the variability in EUVs has not been fully transmitted to producers in the prices they receive.

Real exchange rates have played a major buffering role, but so too have domestic marketing arrangements and government interventions. In fact, most export producers face price variability that appears to be largely determined by factors other than variations in the local currency value of their country's EUVs.

Despite the significant buffering of producer prices, the CVs typically fall in the 10 - 30% range. Lower CVs are found in some African countries where there has been a stronger tradition of price fixing for export crops.

It is also revealed that price variability is the dominant source of instability in crop revenue for most producers; with CVs in the 20 - 40% range, the latter is even higher than price instability. At such levels of risk, producers are likely to substantially discount the returns from export crops, perhaps by as much as 20%, to compensate for risk. Unless they have efficient means for diffusing these risks, price variability could be a significant impediment to the expansion of agricultural exports in many developing countries. This is an issue that warrants further investigation.

ANNEX 1

DEFINITION OF WORLD PRICES

COMMODITY	UNIT	DEFINITION
bananas	$/mt	Central and South American, first-class quality tropical pack, importer's price to jobber or processor, FOB U.S. ports; beginning January 1987, prices have been estimated based on average wholesale prices at New York City and Chicago.
beef	c/kg	U.S., imported frozen boneless, 85% visible lean cow meat, FOB port of entry
cocoa	c/kg	daily price, average, New York and London, nearest 3 future trading months
coconut oil	$/mt	Philippines/Indonesian, bulk, CIF Rotterdam
coffee	c/kg	indicator price, other mild arabicas, average New York and Bremen/Hamburg markets, ex-dock
copra	$/mt	Philippines/Indonesian, bulk, CIF N.W. Europe
cotton	c/kg	"Cotton Outlook", "A" index, middling (1-3/32"), CIF Europe
groundnut oil	$/mt	any origin, CIF Rotterdam
jute	$/mt	Bangladesh, white D, FOB Chittagong/Chalna
maize	$/mt	U.S., No. 2 yellow, FOB U.S. gulf ports
oranges	$/mt	Mediterranean exporters, navel, EEC indicative import price, CIF Paris
palm oil	$/mt	Malaysian, 5% bulk, CIF N.W. Europe
rice	$/mt	Thai, white, milled, 5% broken, government standard, export price, FOB Bangkok
rubber	c/kg	RSS No. 1, in bales, sport, New York
sorghum	$/mt	U.S., No. 2 Milo yellow, FOB gulf ports
soybean oil	$/mt	dutch, crude, FOB ex-mill
soybeans	$/mt	U.S., CIF Rotterdam

sugar	c/kg	world, ISA daily price, FOB and stowed at Greater Caribbean ports
tea	c/kg	London auctions, price received for all tea
wheat	$/mt	Canadian, No. 1, western red spring (cwrs), in store, Thunder Bay; from April 1985, St. Lawrence export

COMMODITY DEFINITION DIFFERENCES

	FAO		WORLD BANK
TYPE	PRODUCTION	TRADE	WORLD
cocoa	cocoa beans	cocoa beans	cocoa
coffee	coffee/green beans	coffee/green beans	coffee
cotton	seed cotton	cotton lint	cotton middling
rice	paddy rice	milled paddy rice	white milled rice
rubber	natural rubber	natural dry rubber	rubber
sugar	sugar cane	centrifugal raw sugar	sugar

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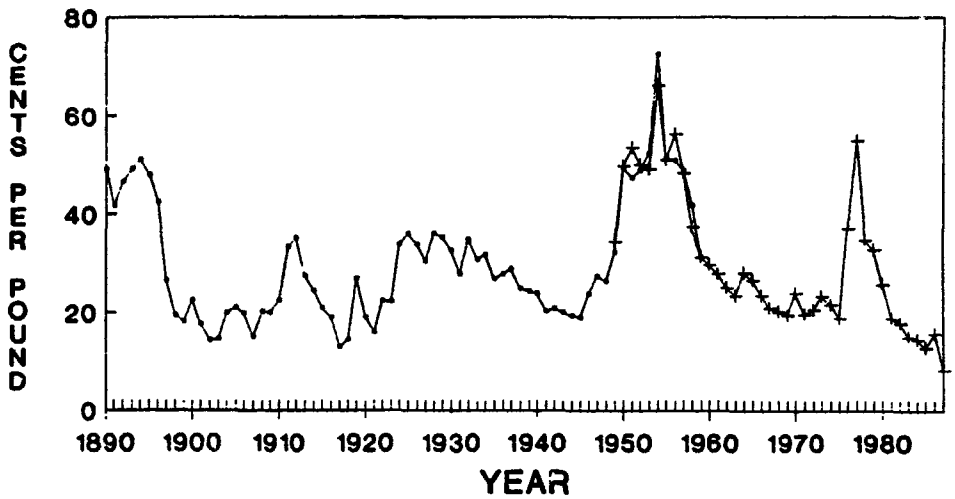
FIGURE 1

REAL INTERNATIONAL COFFEE PRICES
NEW YORK PRICES

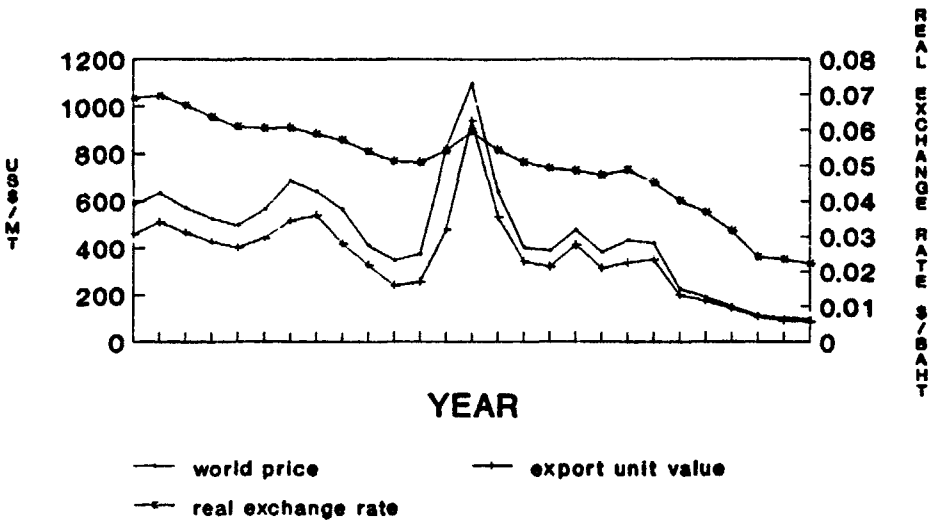


OTHER MILD ARABICAS prices deflated by the IMF's World Consumer Price Index, 1949=100. Indicator price, average New York and Bremen/Hamburg Markets, ex-dock. Source: World Bank, IECCM.

SANTOS NO. 4 spot prices deflated by BLS Wholesale Price Index, 1947-49=100. For 1890-1896, Rio "fair to prime"; 1897-1907, Rio 7's. Source: IBRD (1958), The Coffee Problem.

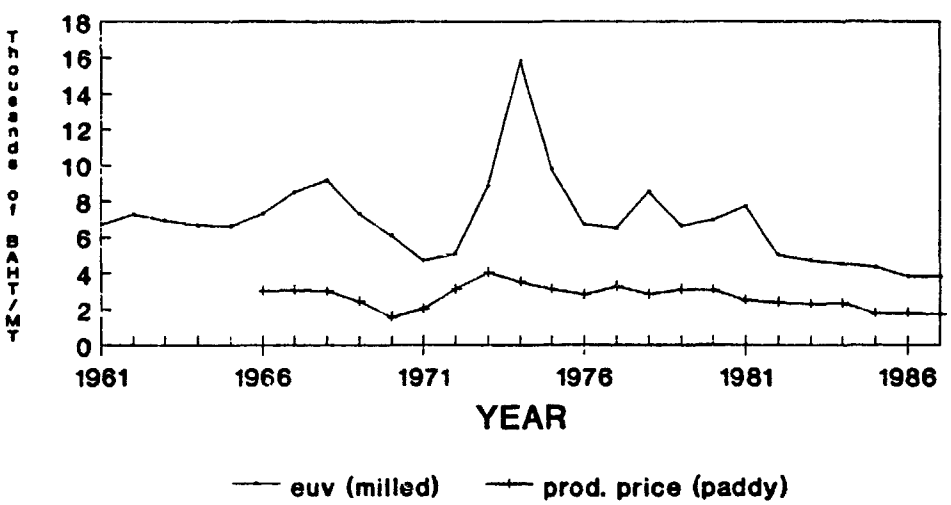
FIGURE 2

THAI RICE
WORLD PRICE, EXPORT UNIT VALUE AND REAL EXCHANGE RATE



** Values based on 1980 prices

THAI RICE
REAL EXPORT UNIT VALUE AND PRODUCER PRICE



** Values based on 1980 prices

TABLE 1. VARIABILITY OF WORLD PRICES FOR SELECTED AGRICULTURAL COMMODITIES, 1949-87

	BANANAS	COCOA	COCONUT OIL	COFFEE	COPRA	COTTON	GROUNDNUT OIL	MAIZE	PALM OIL	RICE	RUBBER	SUGAR	TEA	TOBACCO	WHEAT
Coefficient of variation (%), 1949-87	9.55	37.68	24.03	32.81	26.27	28.29	27.26	21.16	24.83	27.79	38.19	41.65	18.10	10.77	23.12
10-year moving coefficients of variation (%)															
1949-58	3.14	24.71	9.40	18.25	13.36	22.35	16.14	15.27	17.69	8.44	35.51	9.33	16.46	5.87	11.52
1950-59	4.68	21.10	11.53	16.07	14.71	24.71	17.39	16.65	10.73	8.07	29.82	10.45	16.74	6.89	11.21
1951-60	6.01	23.12	11.77	16.90	13.79	26.01	16.52	15.75	10.19	9.57	30.28	9.57	17.20	7.39	11.86
1952-61	7.40	26.92	12.34	21.85	12.91	11.49	11.03	11.64	8.19	10.07	18.44	7.46	16.12	7.17	10.78
1953-62	9.10	30.90	12.77	25.13	12.53	9.39	12.44	9.99	5.53	10.09	18.57	7.43	10.32	7.12	6.61
1954-63	9.38	33.21	12.21	28.44	12.23	9.48	12.63	8.65	5.39	6.84	16.72	17.58	7.18	7.65	2.59
1955-64	9.44	23.59	12.38	24.09	12.56	7.47	11.59	7.45	5.08	5.04	14.60	17.85	5.86	7.63	3.04
1956-65	9.41	25.60	12.60	23.62	13.32	4.79	11.59	8.10	6.18	5.09	13.53	19.69	4.87	8.04	3.05
1957-66	9.21	27.25	12.42	16.91	13.74	4.43	9.88	9.35	6.33	6.13	14.80	21.77	4.39	8.24	3.20
1958-67	7.39	27.86	12.41	9.08	13.49	3.26	7.84	9.48	5.82	11.67	17.60	23.08	5.05	8.39	3.23
1959-68	7.21	19.87	13.70	6.87	14.08	3.58	8.09	9.51	9.71	13.94	19.89	24.86	7.91	8.99	2.89
1960-69	7.36	20.03	11.16	7.21	9.72	3.12	8.56	9.05	11.22	13.97	18.16	25.55	10.49	8.85	3.78
1961-70	7.40	20.29	12.18	9.09	10.02	3.24	9.72	7.14	12.13	13.82	10.98	26.20	10.67	8.98	4.93
1962-71	8.09	21.28	10.66	9.44	9.55	5.34	13.15	5.71	12.92	15.58	11.07	26.65	11.20	8.64	5.90
1963-72	8.94	21.03	13.02	9.66	12.48	8.14	14.30	5.89	13.54	16.86	10.28	27.24	10.72	8.68	5.83
1964-73	6.23	25.49	14.93	10.95	16.52	23.49	17.30	16.08	16.74	25.81	18.32	21.86	10.80	7.95	23.17
1965-74	4.43	31.27	31.26	12.24	38.00	28.24	36.97	26.81	35.19	39.70	24.00	63.28	10.14	8.33	36.90
1966-75	7.00	26.16	33.76	12.83	40.51	28.11	37.94	27.38	36.75	37.89	25.83	61.05	9.60	5.93	38.03
1967-76	8.62	28.17	35.75	29.24	41.51	29.10	38.24	28.13	37.39	38.85	28.48	57.87	10.00	6.22	37.65
1968-77	10.04	43.83	36.45	48.28	41.98	28.37	33.36	27.15	37.36	41.33	28.39	56.81	22.24	6.41	38.56
1969-78	10.90	44.90	37.78	48.22	43.03	27.21	26.18	25.53	33.32	42.55	28.51	55.08	24.17	6.08	38.21
1970-79	12.31	44.63	38.63	42.92	43.05	23.60	26.39	24.39	28.74	44.08	29.50	54.05	23.74	7.41	36.43
1971-80	14.12	41.42	40.75	41.59	44.09	19.03	25.38	23.84	28.10	42.17	34.07	50.15	24.14	8.00	33.79
1972-81	12.21	37.58	43.78	39.57	44.62	15.57	25.15	23.01	27.52	38.40	28.13	49.05	23.48	8.04	30.88
1973-82	11.14	37.00	43.59	38.27	43.12	13.52	28.98	22.66	25.71	39.01	19.69	52.55	22.47	7.81	30.24
1974-83	8.87	40.37	47.37	39.49	46.82	13.00	33.51	23.92	29.18	43.96	21.02	57.39	20.03	8.11	32.88
1975-84	8.18	44.91	27.43	40.21	28.40	13.38	25.48	15.94	18.59	27.08	23.00	44.20	21.81	12.72	23.25
1976-85	7.89	48.26	29.62	40.22	30.30	16.82	28.24	12.83	19.80	28.00	19.54	38.51	20.77	16.18	18.76
1977-86	8.89	55.14	35.39	43.39	35.75	18.78	31.80	13.06	28.17	33.54	20.27	43.30	20.68	19.86	17.04
1978-87	10.33	52.18	41.11	31.19	41.25	20.08	36.74	17.16	30.22	38.71	20.77	47.75	15.90	23.01	20.50
Regression t statistics a\															
Price trend	-26.59•	-3.31•	-9.25•	-6.20•	-8.91•	-9.91•	-9.25•	-12.09•	-10.78•	-7.70•	-8.86•	-3.08•	-16.90•	-16.39•	-9.51•
10-year moving CV	2.84•	6.78•	8.64•	4.28•	7.12•	1.43	5.73•	3.01•	5.27•	8.41•	0.63	7.88•	3.78•	3.59•	4.39•
10-year moving standard deviations	-3.29•	3.05•	3.70•	1.36	3.05•	-1.43	2.11•	-0.07	2.10•	3.97•	-4.97•	4.75•	-2.59•	0.03	2.57•
10-year moving mean	-29.88•	-2.10•	-20.65•	-5.78•	-18.88•	-10.08•	-8.97•	-14.10•	-14.01•	-9.84•	-15.14•	-2.44•	-25.97•	-36.23•	-11.03•
Residual trend	-1.20	0.64	1.16	-1.31	0.40	-2.08•	-0.43	-2.22•	-1.18	1.57	-3.95•	1.70	-3.11•	2.09•	0.02

\a All regressions are linear trend.
Note: • denotes t statistics that are significantly different from zero at 5 percent level or better (2-tailed tests).

TABLE 2: VARIABILITY OF EXPORT UNIT VALUES (EUVs) FOR SELECTED COUNTRIES, 1961-87, U.S.$

Country/ Commodity	CV of EUV (%)	Ratio of CVs: EUV to world price	Correlation between EUV and world price	Regression t statistics: EUV residual trend
Argentina				
maize	24.66	1.06	0.98	0.87
wheat	30.59	0.98	0.92	1.19
Brazil				
coffee	41.89	1.18	0.99	1.98
Colombia				
coffee	38.90	0.91	0.98	1.72
Costa Rica				
bananas	18.70	1.35	0.87	-1.87
coffee	37.87	1.02	0.98	2.08
Guatemala				
coffee	32.14	0.87	0.94	2.14*
cotton	18.02	0.56	0.36	0.95
Burkina Faso				
cotton	36.42	1.58	0.40	-1.41
Cameroon				
cocoa	43.87	0.92	0.95	2.60*
coffee	31.92	0.86	0.90	2.54*
Cote D'Ivoire				
bananas	25.81	2.55	0.54	0.08
cocoa	41.27	0.87	0.94	2.92*
coffee	36.05	0.97	0.93	2.60*
Ethiopia				
coffee	40.09	1.08	0.97	1.60
Ghana				
cocoa	42.52	0.90	0.86	3.19*
Kenya				
coffee	37.36	1.01	0.99	2.01
tea	14.64	0.84	0.87	0.71
Madagascar				
coffee	35.28	0.95	0.93	2.62*
Malawi				
tea	12.93	0.74	0.85	-0.79
tobacco	25.64	1.94	0.47	0.77
Rwanda				
coffee	34.70	0.94	0.94	0.98
Senegal				
groundnut oil	29.88	0.87	0.89	1.29
Sudan				
cotton	20.34	0.88	0.80	1.66
Tanzania				
coffee	39.60	1.07	0.99	1.85
cotton	20.23	0.88	0.81	1.41
Malaysia				
palm oil	27.80	0.95	0.92	0.96
rubber	22.43	1.00	0.99	-1.15
Philippines				
coconut oil	37.84	1.18	0.95	0.69
copra	34.68	0.79	0.96	0.67
sugar	42.32	0.77	0.86	0.17
Sri Lanka				
rubber	21.39	0.95	0.94	-1.28
tea	17.12	0.98	0.96	-1.92
Thailand				
maize	24.16	1.04	0.96	0.98
rice	39.32	1.02	0.96	0.28
rubber	24.18	1.07	0.98	-1.24
Turkey				
cotton	23.78	1.03	0.84	0.90
tobacco	22.91	0.42	0.21	-1.40

Note: A '*' denotes a t-stastistic which is significant at the 5% level (two-tailed tests).

TABLE 8: VARIABILITY OF PRODUCER PRICES (PP) FOR SELECTED COUNTRIES

Country/ Commodity	Period	CV of PP (%) \a		Ratio of CVs: PP to EUV \b	Correlation between PP and EUV	Regression t statistics		
		Total Variability	Risk			Price trend	PP residual trend	PP and EUV cross product trend
Brazil								
coffee	1966-84	49.15	32.21	1.10	0.91	0.76	1.72	1.07
Colombia								
coffee	1966-81	19.76	19.37	0.63	0.80	1.36	2.94*	1.65
Costa Rica								
bananas	1966-87	21.01	18.63	1.66	0.36	5.18*	1.49	-0.17
coffee	1966-87	31.33	27.37	0.71	0.89	2.32*	1.00	0.30
Guatemala								
coffee	1967-82	30.10	30.63	0.98	0.93	0.85	1.88	1.25
cotton	1967-81	12.67	11.26	1.10	-0.13	0.07	1.07	1.13
Burkina Faso								
cotton	1966-87	11.18	7.89	0.41	-0.10	-2.56*	3.21*	-2.24*
Cameroon								
cocoa	1966-86	11.80	9.89	0.27	-0.18	4.34*	-0.49	-0.12
coffee	1966-86	9.06	8.09	0.26	-0.06	-6.28*	-1.73	0.43
Cote D'Ivoire								
bananas	1966-84	10.55	10.95	0.37	-0.08	-5.40*	-1.95	-1.63
cocoa	1966-84	13.23	7.72	0.34	0.66	1.42	1.02	2.87*
coffee	1966-84	8.86	7.47	0.18	0.22	-3.48*	0.20	1.56
Ethiopia								
coffee	1967-83	21.37	20.85	0.51	0.86	-1.08	0.89	0.65
Ghana								
cocoa	1966-87	25.38	20.72	0.56	-0.15	-5.13*	0.16	-1.55
Kenya								
coffee	1966-87	36.56	31.40	0.85	0.96	0.39	0.42	0.21
tea	1966-87	24.92	21.10	1.38	0.70	-0.66	0.39	0.11
Madagascar				@				
coffee	1966-87	13.70	10.24	0.35	0.44	-6.52*	-3.72*	0.51
Malawi								
tea	1968-83	12.85	13.06	1.04	0.26	0.65	-.19	-0.40
tobacco	1968-87	15.63	16.32	0.57	-0.13	-0.16	-0.64	-0.63
Rwanda								
coffee	1966-87	11.89	14.11	0.31	0.79	-6.39*	0.53	0.26
Senegal								
groundnut oil	1967-87	13.07	13.36	0.34	0.57	-0.81	-1.54	-0.90
Sudan								
cotton	1966-81	7.64	6.20	0.52	0.36	-3.89*	-0.47	1.17
Tanzania								
coffee	1966-87	26.78	26.89	0.59	-0.08	-6.52*	-1.38	-1.15
cotton	1966-87	11.45	9.04	0.46	-0.17	-5.48*	-1.77	-0.20
Malaysia								
palm oil	1966-81	16.91	17.35	0.67	0.83	3.14*	-2.09	-0.69
rubber	1967-82	11.51	15.14	0.56	0.66	-2.67*	2.70*	2.60*
Philippines								
sugar	1966-82	23.34	23.32	0.49	0.24	-3.26*	-1.77	-.20
Sri Lanka								
rubber	1966-83	24.32	20.80	1.16	0.53	4.76*	0.36	0.80
tea	1966-81	23.47	26.24	1.57	0.86	3.82*	1.18	0.71
Thailand								
maize	1966-87	21.54	15.36	0.77	0.95	-2.37*	-0.80	-0.79
rice	1966-87	21.55	17.00	0.49	0.60	-2.17*	-0.65	-0.66
rubber	1966-84	15.73	16.19	0.67	0.78	-1.16	0.99	0.92
Turkey								
cotton	1967-87	22.55	18.66	0.79	0.76	-0.91	-0.83	-0.79
tobacco	1966-84	32.95	20.45	1.45	0.91	-0.82	1.02	0.35

Notes:
A "*" denotes a t statistic which is significant at the 5% level (two-tailed tests).
\a Total variability is variability measured around a linear trend; risk is the variability measured around a weighted average of prices observed in the preceding three years.
\b Producer prices are valued in constant local currency, export unit values in constant U.S.$. Both series are detrended using a linear trend.

TABLE 4: DISAGGREGATION OF THE COMPONENTS OF THE VARIANCE IN PRODUCER PRICES (%)

Country/ Commodity	Period	Variance component				
		Variance EUV$	Variance rr	Covariance EUV$ and rr	σ^2	R
Brazil						
coffee	1966-84	107.63	43.55	-70.76	59.06	-39.38
Colombia						
coffee	1966-81	76.77	3.72	-2.36	24.87	-3.00
Costa Rica						
bananas	1966-87	8.19	45.45	-13.63	58.15	1.85
coffee	1966-87	178.97	70.96	-143.95	42.61	-48.59
Guatemala						
coffee	1967-82	103.95	2.11	-17.18	15.81	-4.69
cotton	1967-81	2.61	0.22	-1.01	105.87	-7.68
Burkina Faso						
cotton	1966-87	11.65	10.36	-11.21	93.42	-4.22
Cameroon						
cocoa	1966-86	8.93	2.82	-7.53	102.25	-6.47
coffee	1966-86	6.56	3.35	-6.63	103.34	-6.62
Cote D'Ivoire						
bananas	1966-84	3.52	2.68	-2.81	103.92	-7.31
cocoa	1966-84	102.25	41.74	-92.96	67.74	-18.76
coffee	1966-84	3.30	1.48	-2.75	104.44	-6.47
Ethiopia						
coffee	1967-83	115.90	5.22	-32.03	24.41	-13.50
Ghana						
cocoa	1966-87	78.09	153.35	-104.59	32.38	-59.23
Kenya						
coffee	1966-87	172.58	48.93	-106.41	19.66	-34.77
tea	1966-87	41.49	67.80	-36.85	35.60	-8.04
Madagascar						
coffee	1966-87	10.69	8.66	-8.71	98.51	-9.14
Malawi						
tea	1968-83	1.94	1.20	-0.01	103.71	-6.85
tobacco	1968-87	0.04	0.03	-0.03	105.52	-5.56
Rwanda						
coffee	1966-87	90.53	12.31	-33.56	48.03	-17.32
Senegal						
groundnut oil	1967-87	51.63	20.28	-36.12	72.19	-7.99
Sudan						
cotton	1966-81	48.65	10.25	-20.17	69.47	-8.20
Tanzania						
coffee	1966-87	0.80	0.40	-0.18	104.18	-5.20
cotton	1966-87	2.15	3.64	-1.98	102.27	-6.07
Malaysia						
palm oil	1966-81	154.27	18.12	-69.05	12.81	-16.15
rubber	1967-82	68.38	15.39	-37.98	58.08	-3.37
Philippines						
sugar	1966-82	10.80	0.40	-0.78	96.46	-6.88
Sri Lanka						
rubber	1966-83	28.19	45.52	-1.20	26.70	0.80
tea	1966-81	4.62	18.33	6.16	74.24	-3.36
Thailand						
maize	1966-87	79.34	46.74	-74.51	63.27	-14.84
rice	1966-87	23.86	5.62	-10.27	89.43	-8.64
rubber	1966-84	103.29	20.57	-53.85	36.51	-6.52
Turkey						
cotton	1967-87	32.25	40.05	-42.71	77.56	-7.15
tobacco	1966-84	2.89	4.85	-3.70	102.62	-6.65

TABLE 5: THE VARIABILITY OF PRODUCER REVENUE (LOCAL CURRENCY UNITS)

Country/ Commodity	Period	CV of producer revenue \a		Ratio of CVs \b: producer revenue to producer price	Correlation between production and producer price	Regression t statistics
		Total Variability	Risk			Producer revenue residual trend
Brazil						
coffee	1966-84	44.01	42.94	0.90	-0.43	2.08
Colombia						
coffee	1966-81	20.93	17.18	1.06	-0.28	1.95
Costa Rica						
bananas	1966-87	24.16	20.01	1.15	-0.36	3.13*
coffee	1966-87	29.86	23.05	0.95	-0.21	2.07
Guatemala						
coffee	1967-82	35.83	34.45	1.19	0.27	1.99
cotton	1967-81	23.09	18.77	1.82	0.12	2.38*
Burkina Faso						
cotton	1966-87	33.53	23.54	3.00	0.40	3.88*
Cameroon						
cocoa	1966-86	20.11	11.90	1.70	0.50	-1.96
coffee	1966-86	18.36	20.48	2.03	0.18	1.85
Cote D'Ivoire						
bananas	1966-84	19.13	18.21	1.81	0.18	-1.70
cocoa	1966-84	18.81	19.48	1.42	-0.06	3.27*
coffee	1966-84	25.27	24.82	3.67	-0.14	0.54
Ethiopia						
coffee	1967-83	22.12	20.52	1.04	-0.25	0.79
Ghana						
cocoa	1966-87	38.82	27.02	1.53	0.56	-2.97*
Kenya						
coffee	1966-87	49.88	45.29	1.36	0.49	0.86
tea	1966-87	31.69	38.58	1.27	-0.04	1.55
Madagascar						
coffee	1966-87	17.90	14.18	1.31	0.09	-1.38
Malawi						
tea	1966-83	18.46	16.63	0.47	0.35	1.02
tobacco	1966-87	27.58	29.28	1.74	0.34	2.21*
Rwanda						
coffee	1966-87	19.85	21.82	1.67	0.08	1.93
Senegal						
groundnut oil	1967-87	36.94	42.70	2.83	0.30	-0.37
Sudan						
cotton	1966-81	28.64	23.78	3.75	0.26	-1.26
Tanzania						
coffee	1966-87	30.38	29.12	1.13	-0.03	-2.95*
cotton	1966-87	17.89	15.53	1.56	-0.23	-2.58*
Malaysia						
palm oil	1966-81	20.09	14.61	1.19	0.07	2.47*
rubber	1966-82	16.81	18.57	0.57	0.27	1.53
Philippines						
sugar	1966-82	28.06	25.61	1.20	0.18	-1.64
Sri Lanka						
rubber	1966-83	27.55	25.19	1.13	0.17	1.49
tea	1966-81	22.63	26.03	0.96	-0.11	1.15
Thailand						
maize	1966-87	32.50	26.49	1.51	0.22	0.74
rice	1966-87	21.45	19.30	1.00	-0.14	0.28
rubber	1966-84	20.55	18.19	1.31	0.44	2.10
Turkey						
cotton	1967-87	31.70	29.31	1.41	0.69	-0.74
tobacco	1966-84	55.12	37.81	1.67	0.69	0.87

Note: \a Total variability is variability measured around an exponential trend; risk is the variability measured around a weighted average of the revenues observed in the preceding three years.
\b Total variability CVs.
A "*" denotes a t statistic which is significant at the 5% level (two-tailed tests).

TABLE 6: DISAGGREGATION OF THE COMPONENTS OF THE VARIANCE OF PRODUCER REVENUE (%)

Country/ Commodity	Period	Variance Component			
		Variance PP	Variance production	Covariance PP and production	Residual
Brazil					
coffee	1966-84	132.43	48.96	-68.08	-13.31
Colombia					
coffee	1966-81	103.24	32.55	-30.36	-5.44
Costa Rica					
bananas	1966-87	96.78	62.15	-54.85	-4.59
coffee	1966-87	121.33	12.75	-15.95	-18.12
Guatemala					
coffee	1967-82	81.46	2.85	7.73	7.96
cotton	1967-81	35.15	70.08	11.09	-16.32
Burkina Faso					
cotton	1966-87	16.25	50.69	21.99	11.07
Cameroon					
cocoa	1966-86	31.04	38.36	32.76	-2.16
coffee	1966-86	21.59	68.39	11.76	-1.74
Cote D'Ivoire					
bananas	1966-84	33.58	49.03	12.11	5.28
cocoa	1966-84	60.32	59.35	-7.06	-12.62
coffee	1966-84	7.14	101.94	-6.93	-2.15
Ethiopia					
coffee	1967-83	101.76	7.60	-13.02	3.67
Ghana					
cocoa	1966-87	50.27	18.27	32.24	-0.78
Kenya					
coffee	1966-87	50.77	6.73	16.93	25.58
tea	1966-87	79.82	17.72	-2.96	5.43
Madagascar					
coffee	1966-87	68.39	20.16	6.04	5.41
Malawi					
tea	1968-83	47.53	26.62	23.45	2.40
tobacco	1968-87	34.30	39.47	23.38	2.86
Rwanda					
coffee	1966-87	36.75	54.58	6.92	1.75
Senegal					
groundnut oil	1967-87	12.16	63.23	15.90	8.71
Sudan					
cotton	1966-81	7.26	82.81	12.06	-2.14
Tanzania					
coffee	1966-87	85.79	16.66	-1.95	-0.50
cotton	1966-87	46.62	76.87	-25.99	2.51
Malaysia					
palm oil	1966-81	60.56	29.79	5.58	4.07
rubber	1967-82	53.71	29.96	20.41	-4.07
Philippines					
sugar	1966-82	71.88	17.94	12.12	-1.94
Sri Lanka					
rubber	1966-83	80.70	6.91	7.61	4.78
tea	1966-81	99.37	1.42	-2.46	1.67
Thailand					
maize	1966-87	40.91	39.36	16.75	2.99
rice	1966-87	96.46	10.55	-8.64	1.63
rubber	1966-84	67.63	7.84	19.36	5.16
Turkey					
cotton	1967-87	48.59	9.23	27.46	14.72
tobacco	1966-84	32.78	14.33	27.56	25.33

Note: Production data were detrended using an exponential trend; producer prices were detrended using a linear trend; and detrended revenue was calculated as the product of the detrended price and production data.

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